

## ABSTRACT OF THE INVENTION

A reversible physiological process provides for the temporal separation of oxygen evolution and hydrogen production in a microorganism, which includes the steps of growing a culture of the microorganism in medium under illuminated conditions to accumulate an

- 5 endogenous substrate, depleting from the medium a nutrient selected from the group consisting of sulfur, iron, and/or manganese, sealing the culture from atmospheric oxygen, incubating the culture in light whereby a rate of light-induced oxygen production is equal to or less than a rate of respiration, and collecting an evolved gas. The process is particularly useful to accomplish a sustained photobiological hydrogen gas production in cultures of microorganisms, such as
- 10 *Chlamydomonas reinhardtii*.